

# **Appendix O**

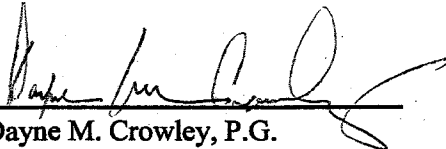
## **Hydrogeological Study Regarding the Town of Springdale, PA Water Quality**


# **Groundwater and Surface Water Relationships In An Alluvial Aquifer with Respect to the Potential Effects of Dredging**

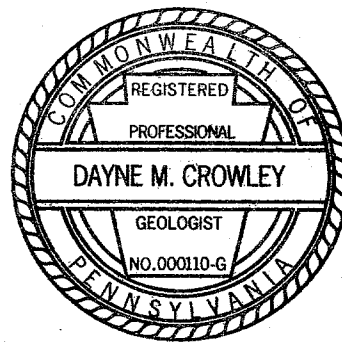
Prepared for

**Pioneer Mid-Atlantic**  
New Kensington, Pennsylvania

Harding-ESE Project No. 48347

  
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## **EXECUTIVE SUMMARY**

### **BACKGROUND**

Pioneer Mid-Atlantic, Inc. (Pioneer) is a commercial sand and gravel aggregate producer that operates a river aggregate dredge on the Allegheny River in Pennsylvania. River aggregate dredging is conducted under the provisions of permits issued by the Pennsylvania Department of Environmental Protection (PADEP) and the US Army Corps of Engineers. In August, 1999, Pioneer received a letter from PADEP that indicated a complaint had been filed by PPG Industries stating that they believe that temperature of cooling water in a production well at their Springdale facility had been impacted as a result of dredging. Additionally, the Borough of Springdale has expressed concern that their wellfield (specifically water quality) might be impacted by dredging. In response, Pioneer voluntarily removed their dredge from the area and began a literature search for information relating to the effects of dredging at similar settings. Because no studies were found that could be referenced, Pioneer undertook completion of this study, which is believed to be the only study that evaluates groundwater and surface water relationships in an alluvial aquifer with respect to the potential effects of dredging.

Harding-ESE, Inc. (Harding-ESE) was contracted by Pioneer to conduct a study to evaluate the influences of surface water on the groundwater flow system along the Allegheny River. The groundwater flow system is located within the calculated capture zone for the Borough of Springdale municipal wellfield that extends into, beneath and across the Allegheny River. The sand and gravel deposits in the Allegheny River at this location have been, and continue to be, dredged. This study has been developed to evaluate the interrelationships of the surface water and groundwater systems during the periods when dredging is occurring and during the periods when dredging is not occurring, and to determine whether dredging influences the interrelationships.

Harding-ESE, with concurrence from PADEP, designed this study to measure parameters in surface water and groundwater that were indicative of the water systems and could be compared to detect changes that might be the result of increased infiltration of surface water to the sand and gravel aquifer. The study design was developed with knowledge of the following facts:

- The Allegheny River and the sand and gravel aquifer are in direct hydraulic communication with each other.
- Groundwater pumping of the sand and gravel aquifer induces flow from the river into the sand and gravel aquifer.
- The sand and gravel deposits that underlie the Allegheny River are the same geologic formation that constitutes the sand and gravel aquifer throughout the valley floor.

### **STUDY RESULTS**

- No effects were observed in the water level data relating to dredging. The hydrographs illustrate seasonal water level variations and periodic runoff occurrences.
- The study further proved that the river and groundwater flow systems are connected, and that the sand and gravel aquifer is stratigraphically equivalent to the sand and gravel riverbed, which is dredged. Groundwater levels in the wells are lower in elevation than the river stage indicating that water flows from the river to the wellfield.

- Water level hydrographs indicate the river and groundwater flow system are connected. The data shows that river water stage elevation is consistently higher than local groundwater levels, indicating that groundwater pumping draws a portion of its flow from the river. The observation wells indicate drawdown on a regular time basis that coincides with the pumping at the Springdale municipal wellfield. This shows that pumping of these wells induces groundwater flow from the river to the alluvial aquifer. The portion of the groundwater flow originating in the river is significant.
- No direct relationships were indicated between temperature of groundwater and temperature of surface water. Dredging did not produce any temperature data that changed from the pre-dredging, to dredging, to post-dredging periods.
- No effects were observed in the temperature data relating to dredging. Temperature data indicates surface seasonal fluctuations that vary from 32° F in the winter to approximately 75° F in the late summer. Daily variations of up to 5° F were common. Temperature data showed groundwater variations to be very small (generally less than 1.0° F) throughout the study, with the highest readings in early May and the lowest readings in late October, indicating a reverse seasonal variation.
- Specific conductance data has maintained the same general order of magnitude values throughout the study. Correlations between specific conductance in surface water and groundwater are consistent, with no effects from dredging.
- Specific conductance data indicated that the time required for groundwater to travel a certain distance had to be considered. When the data were time shifted, in accordance with travel time calculations, correlations between surface water and groundwater were detected. These correlations did not change from pre-dredging, to dredging, to post-dredging periods, indicating no effects from dredging activities.
- Water sample quality results collected during pre-dredging, dredging and post-dredging periods showed no detectable change in water quality during the study. This is especially true with respect to nitrates, which are common in river water.
- Evaluation of the analysis of major cations and anions illustrated that surface water quality is discernibly different than groundwater quality, as graphically shown on the Trilinear diagrams. The water quality analysis does not show any changes in groundwater quality that are attributable to dredging activity throughout the study period.

## STUDY CONCLUSIONS

Upon review of all the data collected during this study, Harding-ESE has not been able to identify any change to groundwater quality or flow that could be related to dredging activities. The advent and cessation of dredging did not produce any changes, trends or patterns in the data collected. Therefore, Harding-ESE believes that the interrelationships that exist between surface water and groundwater are not altered as a result of dredging.

This study area is typical to similar settings along the Allegheny and Ohio Rivers where outwash deposits also comprise the regional alluvial aquifer. Thus, the results of this study are believed to be applicable to other areas of similar geological formations.